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(54) **OIL COOLED PISTON.**

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Oil cooled piston

This invention relates generally to oil cooled pistons.

In the past, to cool pistons in engines and the like, lubricating oil has been sprayed upwardly into a cooling dome and an annular cooling groove adjacent the underside of the piston crown for the purpose of cooling (See US—A—4056044). A ledge or splash sill can be provided for trapping some of the oil and for directing the trapped oil into a cooling chamber to increase the cooling effect (See FR—A—2392 238).

In FR—A—2392 238 a problem exists in that the ledge is positioned at the end of the direct oil to the cooling chamber, and that therefore a quantity of oil directed into the groove may well not traverse its whole length to reach the ledge. Furthermore, due to the flexible nature of the ledge and its position oil is not easily retained above the ledge in the groove.

According to the invention an oil cooled piston which comprises a crown portion; inner and outer annular walls connected to the crown portion and defining therebetween an annular groove open at one end; and a substantially annular ledge extending from the inner wall towards the outer wall, for trapping cooling fluid thereon, the ledge having a surface inclined from the inner wall into the annular groove, is characterized in that the outer wall has an end surface adjacent the open end of the groove, that the surface of the ledge is adjacent the open end of the groove, the ledge extending across the open end of the groove towards the end surface of the outer wall, and that the ledge has an opening for enabling a stream of fluid to be directed past the ledge into the annular groove.

Fluid is thus trapped by the annular ledge so as to be directed back into the groove on movement of the piston, in order to increase the cooling effect.

A number of examples of pistons constructed in accordance with the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is an enlarged cross-sectional view illustrating a first embodiment;

Figure 2 is a bottom plan view taken along the line II—II of Figure 1;

Figure 3 is another enlarged cross-sectional view illustrating a second embodiment;

Figure 4 is a view taken along the line IV—IV of Figure 3;

Figure 5 is an enlarged partial cross-sectional view illustrating a further, preferred embodiment;

Figures 6—8 are enlarged partial cross-sectional views illustrating alternative embodiments; and,

Figures 9, 10 are enlarged partial cross-sectional views illustrating a cooling oil spray during the piston stroke.

A reciprocating piston 10, Figure 1, has a journal pin 12 by which it is connected at boss 15 to a connecting rod 14 at one end 17, the connecting rod connecting to a crankshaft (not shown) at its opposite end in the well known manner. A conventional cylinder liner 16 is provided for guiding the reciprocating action of piston 10.

The piston 10 includes an upper crown portion 18 and a lower skirt portion 20 of the well known type which includes partial skirts 20a, 20b.

The crown portion 18 includes inner and outer wall portions 22, 24 respectively, defining an annular groove 26 closed at an upper end 28 and having an opening at a lower end 30. The outer wall 24 includes conventional grooves 32 carrying compression rings 34. An annular relief 36 is provided between rings 34 and a groove 38 is provided below rings 34 for carrying an oil control ring 40.

The outer wall 24 terminates at an end surface 42 just below the oil control ring 40. The skirt portion 20 is just below the end surface 42 and spaced therefrom by an opening 44.

The inner wall 22 separates the groove 26 from crown 18 and cooling dome 46. The wall 22 extends downwardly past the opening 44 to the pin boss 15.

The piston 10 may be cast from iron to form a thin-walled, light-weight, one-piece unit. However, upper dome portion 18 can be cast separately from lower skirt portion 20 and the portions could then be welded together at 19 by a brazing process if desired.

A conventional piston cooling jet is fixed positioned so as to be adjacent lower skirt 20 when the piston is in its lowest position for spraying a jet of fluid such as lubricating oil upwardly into annular groove 26 and cooling dome 46 as is known. The jet, Figures 9, 10, constantly sprays the oil upwardly to the underside of the crown 18. The spray is directed so that when the piston is bottom dead center or when the reciprocating piston 10 is at its lowermost position relative to the fixed jet 48, the spray bathes and cools groove 26 which has become heated due to proximity to crown 18. When the piston 10 is at top dead center, the spray bathes and cools dome 46. This momentary cooling is advantageous but does not continuously cool both the groove 26 and the dome 46.

To enhance cooling, a splash sill or ledge 50 is provided as a means for trapping oil in the groove 26. Sill 50 is formed as a substantially annular ledge extending radially outwardly from inner wall 22 adjacent opening 44 and reaching

toward outer wall 24. Ledge or sill 50 also extends upwardly towards the crown 18. Ledge 50 terminates at lip portion 52 which is spaced from end surface 42. The preferred configuration for ledge 50 is illustrated in Figure 5.

A sloping upper surface 56 is provided on ledge 50. Surface 56 may be of a substantially constant slope such as that shown in Figures 5—7 or may be curved or cup-shaped such as is shown in Figure 8. Surface 56 provides ledge 50 with angular disposition relative to inner wall 22. Thus, ledge 50 and wall 22 cooperate to form a trough-like fluid trap.

In order to provide the maximum cooling splash for bathing groove 26, it has been discovered according to this invention, that ledge 50 is most advantageously situated as described above, that is, extending outwardly from inner wall 22 and sloped upwardly toward crown 18. However, situated as such, ledge 50 is directly in the oil jet spray path extending between jet 48 and groove 26. Therefore, the ledge 50 includes a slot 60 as a means for permitting the pressurized stream to be directed past ledge 50 and into groove 26, see Figures 2 and 4. As illustrated, there are two slots 60 (180 degrees diametrically opposed) for the purpose of providing a piston which can be installed without concern as to the location of slot 60. However, since only one jet 48 is usually provided, one slot 60 is sufficient.

Piston 10 reciprocates downwardly to bottom dead center and jet 48 directs lubricating oil upwardly past ledge 50 via slot 60 into groove 26. The oil bathes and momentarily cools groove 26, thereafter drains downwardly and is trapped by ledge 50 as piston 10 accelerates upwardly to its top dead center positon where the oil then bathes the dome 46. As piston 10 begins to reverse direction at the top dead center position and reciprocates downward again, oil trapped between surface 56 and inner wall 22 tends to continue upwardly and is thus splashed into groove 26 thus supplementing the direct cooling from the jet spray which thereafter occurs when piston 10 once again reaches bottom dead center.

Claims

1. An oil cooled piston (10) which comprises a crown portion (18); inner (22) and outer (24) annular wall connected to the crown portion (18) and defining therebetween an annular groove (26) open at one end (30); and a substantially annular ledge (50) extending from the inner wall (22) towards the outer wall, for trapping cooling fluid thereon, the ledge having a surface (56) inclined from the inner wall (22) into the annular groove (26), characterized in that the outer wall (24) has an end surface (42) adjacent the open end (30) of the groove (26), that the surface (56) of the ledge is adjacent the open end of the groove (26), the ledge (50) extending across the open end of the groove (26) towards the end surface (42) of the outer wall (24), and that the ledge (5) has an opening (60) for enabling a stream of fluid to be directed past the ledge (50) into the annular groove (26).

2. A piston according to claim 1, wherein the annular ledge (50) is located with its edge (52) spaced from the end surface (42) in a direction downwardly of the groove (26).

3. A piston according to claim 1 or claim 2, wherein the opening comprises a slot (60) in the ledge (50).

4. A piston according to any of claims 1 to 3, wherein the surface (56) has a substantially constant slope relative to the inner wall (22).

5. A piston according to any of claims 1 to 4, wherein the surface (56) extends substantially the full width of the ledge (50).

6. A piston according to any of claims 1 to 5, wherein the edge (52) of the ledge (50) is located radially inwardly of the outer wall (24).

7. A piston according to any of claims 1 to 6, including a lower skirt portion (20) and wherein the edge (52) of the ledge (50) is located above the lower skirt portion (20).

Revendications

1. Piston refroidi à l'huile (10) qui comprend une partie formant tête (18); des parois annulaires interne (22) et externe (24) connectées à la partie formant tête (18) et définissant entre elles une gorge annulaire (26) ouverte à une extrémité (30); et une saillie sensiblement annulaire (50) s'étendant de la paroi interne (22) vers la paroi externe, pour y piéger le fluide de refroidissement, la saillie ayant une surface (56) inclinée depuis la paroi interne (22) dans la gorge annulaire (26), caractérisé en ce que la paroi externe (24) a une surface extrême (42) adjacente à l'extrémité ouverte (30) de la gorge (26), en ce que la surface (56) de la saillie est adjacente à l'extrémité ouverte de la gorge (26), la saillie (50) s'étendant à travers l'extrémité ouverte de la gorge (26) vers la surface extrême (42) de la paroi externe (24), et en ce que la saillie (50) a une ouverture (60) pour permettre à un courant de fluide d'être dirigé au delà de la saillie (50) dans la gorge annulaire (26).

2. Piston selon la revendication 1, dans lequel la saillie annulaire (50) est placée de façon que son bord (52) soit espacé de la surface extrême (42) dans une direction vers le bas de la gorge (26).

3. Piston selon la revendication 1 ou la revendication 2, dans lequel l'ouverture comprend une fente (60) dans la saillie (50).

4. Piston selon l'une des revendications 1 à 3, dans lequel la surface (56) a une pente sensiblement constante par rapport à la paroi interne (22).

5. Piston selon l'une des revendications 1 à 4, dans lequel la surface (56) s'étend sensiblement sur toute la largeur de la saillie (50).

6. Piston selon l'une des revendications 1 à 5, dans lequel le bord (52) de la saillie (50) est placé radialement vers l'intérieur de la paroi externe (24).

7. Piston selon l'une des revendications 1 à 6, comprenant une partie formante jupe inférieure (20) et dans lequel le bord (52) de la saillie (50) est placé au dessus de la partie formant jupe inférieure (20).

Patentansprüche

1. Ölgekühlter Kolben (10), der folgendes aufweist: einen Kronenteil (18), innere (22) und äußere (24) Ringwände verbunden mit dem Kronenteil (18) und dazwischen eine Ringnut (26) definierend, die an einem Ende (30) offen ist, und einen im wesentlichen ringförmigen Absatz (50), der sich von der Innenwand (22) zur Außenwand erstreckt, um Kühlströmungsmittel darauf einzufangen, wobei der Absatz eine von der Innenwand (22) in die Ringnut (26) geneigte Oberfläche (56) aufweist, dadurch gekennzeichnet, daß die Außenwand (24) eine Endoberfläche (42) benachbart zum offenen Ende (30) der Nut (26) besitzt, daß die Oberfläche (56) des Absatzes benachbart zum offenen Ende der Nut (26) liegt, wobei der Absatz 50 sich über das offene Ende der Nut (26) zur Endoberfläche (42) der Aussenwand (24) erstreckt, und daß der Absatz (5) eine Öffnung (60) aufweist, um zu ermöglichen, daß ein Strömungsmittelstrom am Absatz (50) vorbei in die Ringnut (26) geleitet werden kann.

2. Kolben nach Anspruch 1, wobei der Ringabsatz (50) mit seiner Kante (52) mit Abstand gegenüber der Endoberfläche (42) angeordnet ist, und zwar in einer Richtung nach unten gegenüber der Nut (26).

3. Kolben nach Anspruch 1 oder 2, wobei die Öffnung einen Schlitz (60) in dem Absatz (50) aufweist.

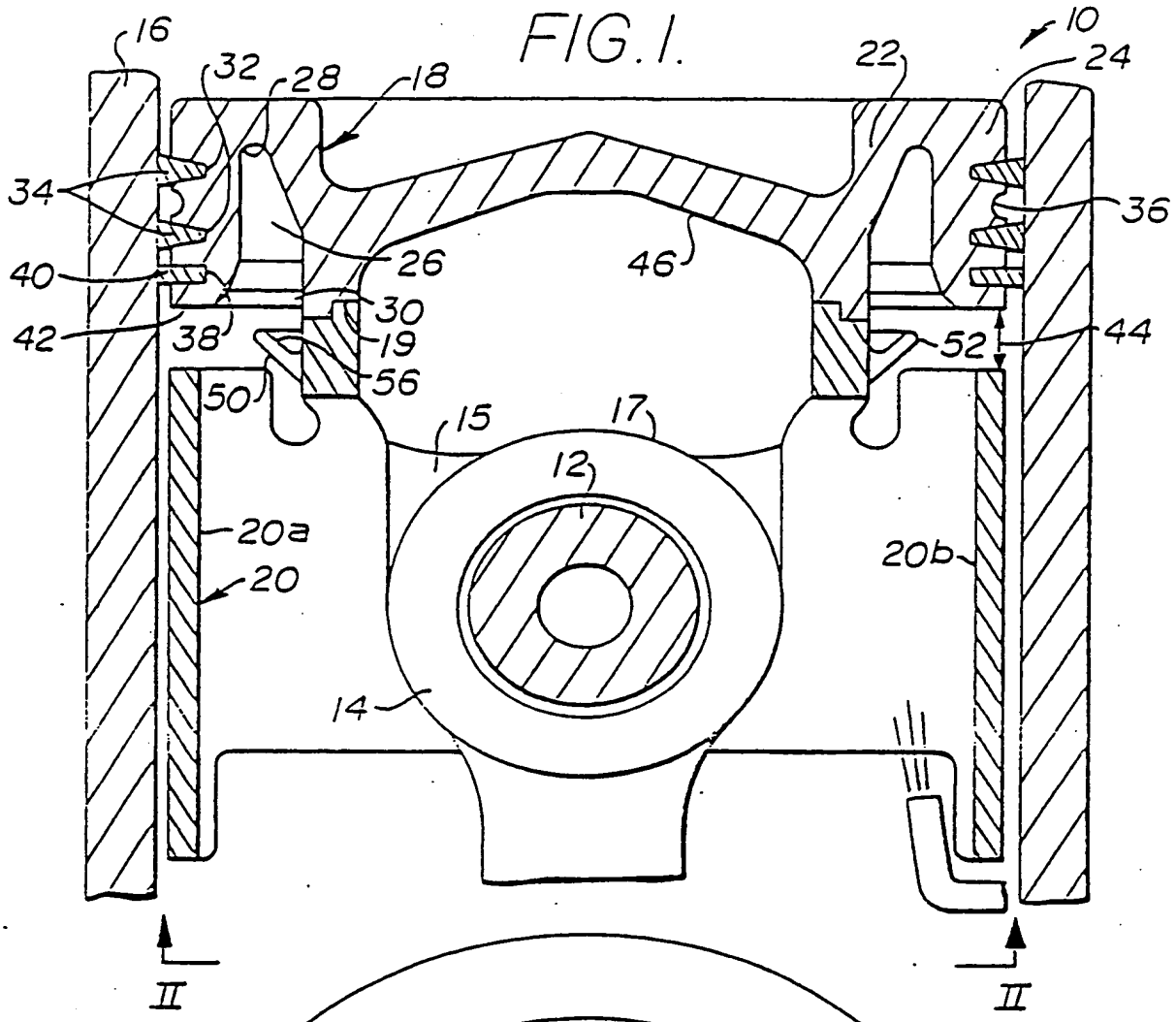
4. Kolben nach einem der Ansprüche 1—3, wobei die Oberfläche (56) eine im wesentlichen konstante Neigung bezüglich der Innenwand (22) aufweist.

5. Kolben nach einem der Ansprüche 1—4, wobei die Oberfläche (56) sich im wesentlichen über die volle Breite des Absatzes (50) erstreckt.

6. Kolben nach einem der Ansprüche 1—5, wobei die Kante (52) des Absatzes (50) radial nach innen gegenüber der Außenwand (24) angeordnet ist.

7. Kolben nach einem der Ansprüche 1—6 mit einem unteren Mantelteil (20), und wobei die Kante (52) des Absatzes (50) oberhalb des unteren Mantelteils (20) angeordnet ist.

FIG. 1.


16
32
28
18
22
10
24
34
36
40
26
46
30
42
38
19
52
44
56
50
15
17
12
20a
20b
20
14
II
II

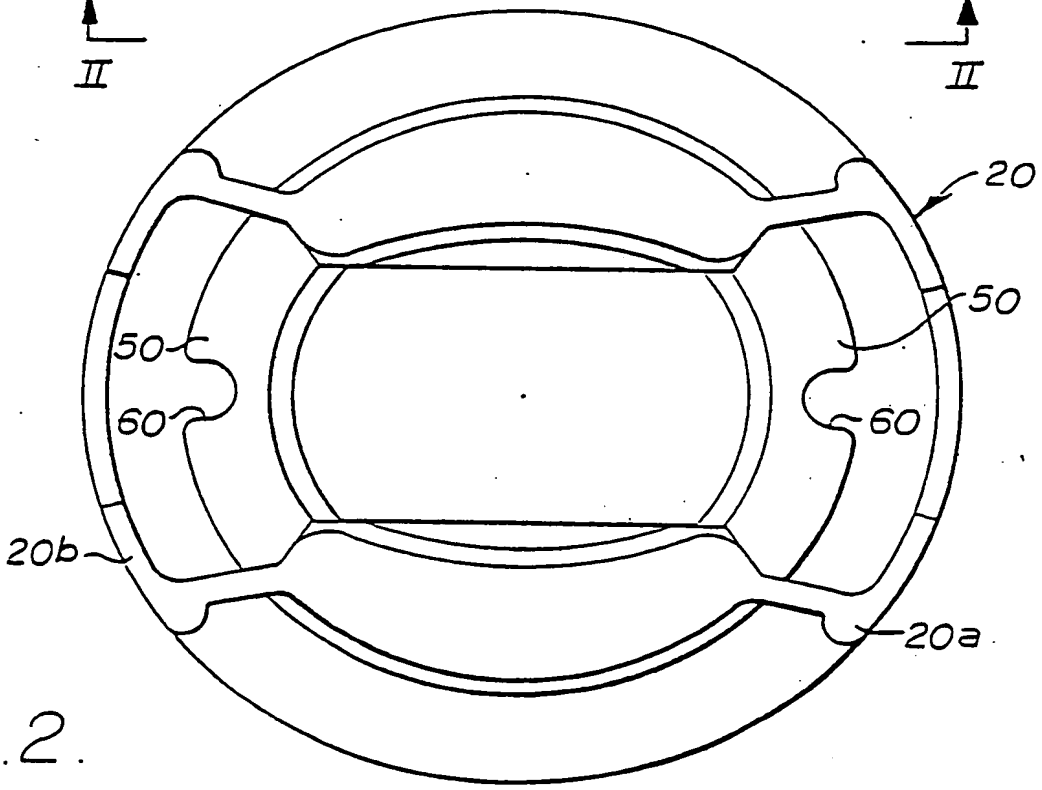

20
50
50
60
60
20b
20a

FIG. 2.

FIG.3.

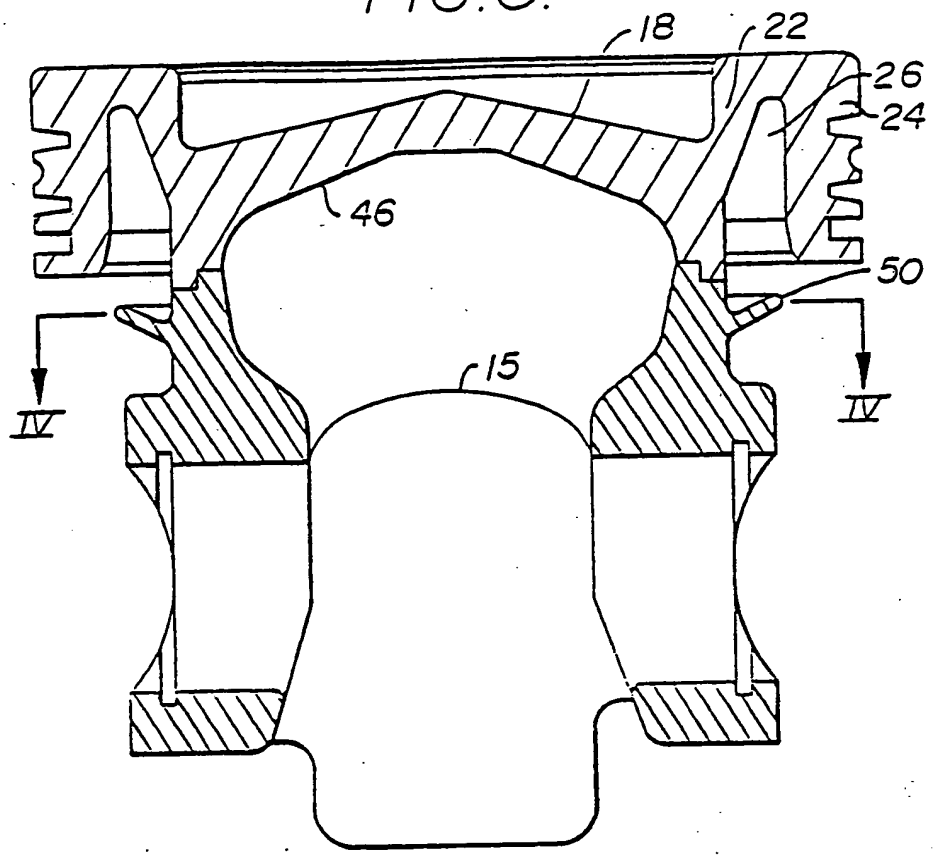


FIG.4.

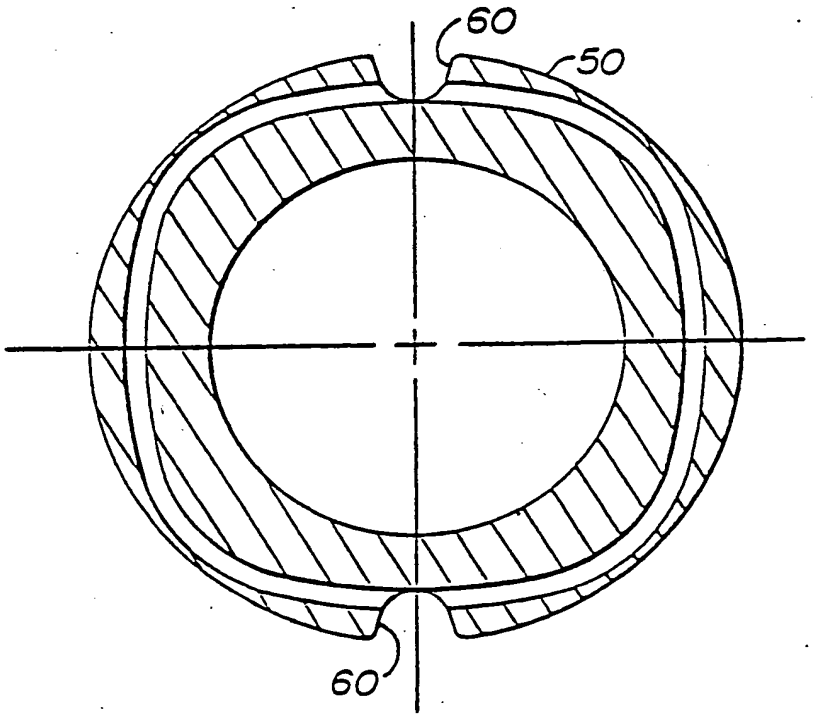


FIG.5.

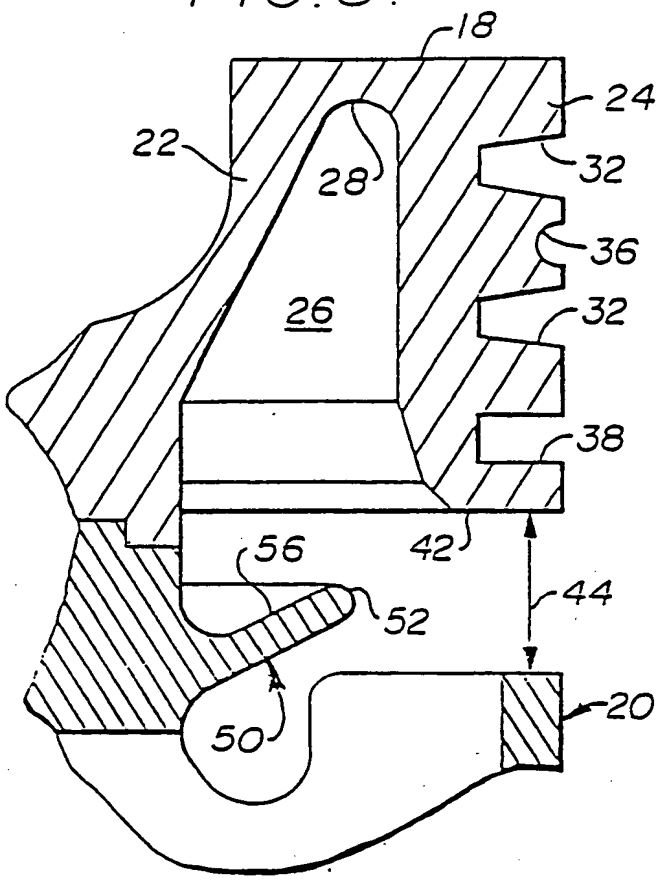


FIG.6.

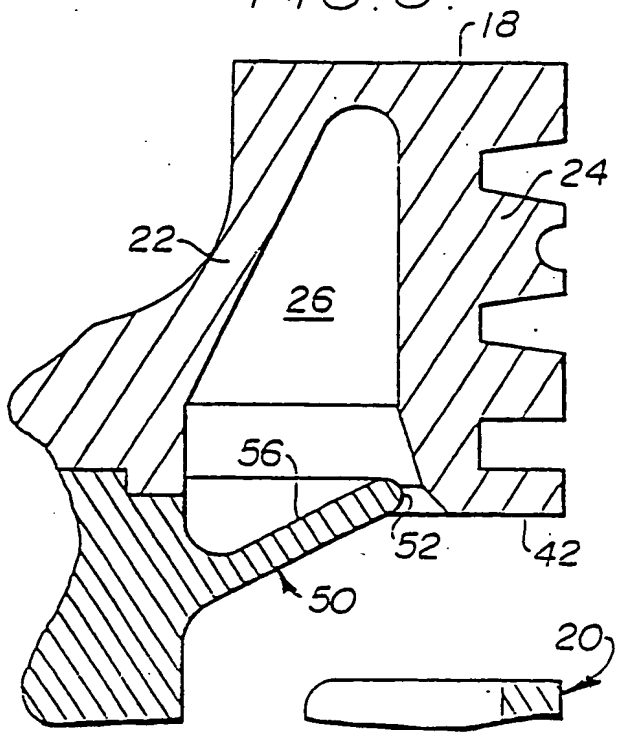


FIG.7.

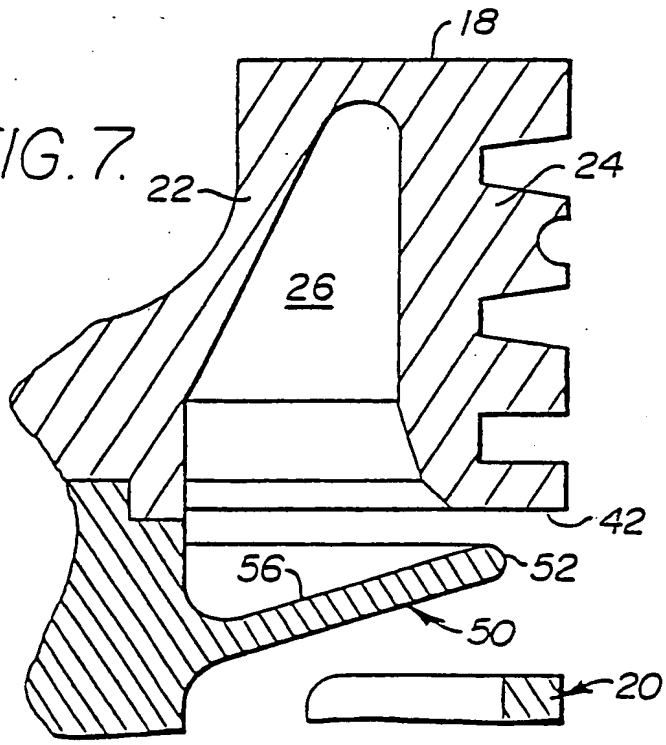


FIG.8.

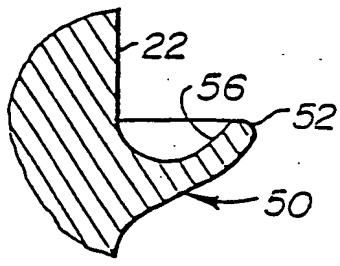


FIG. 9.

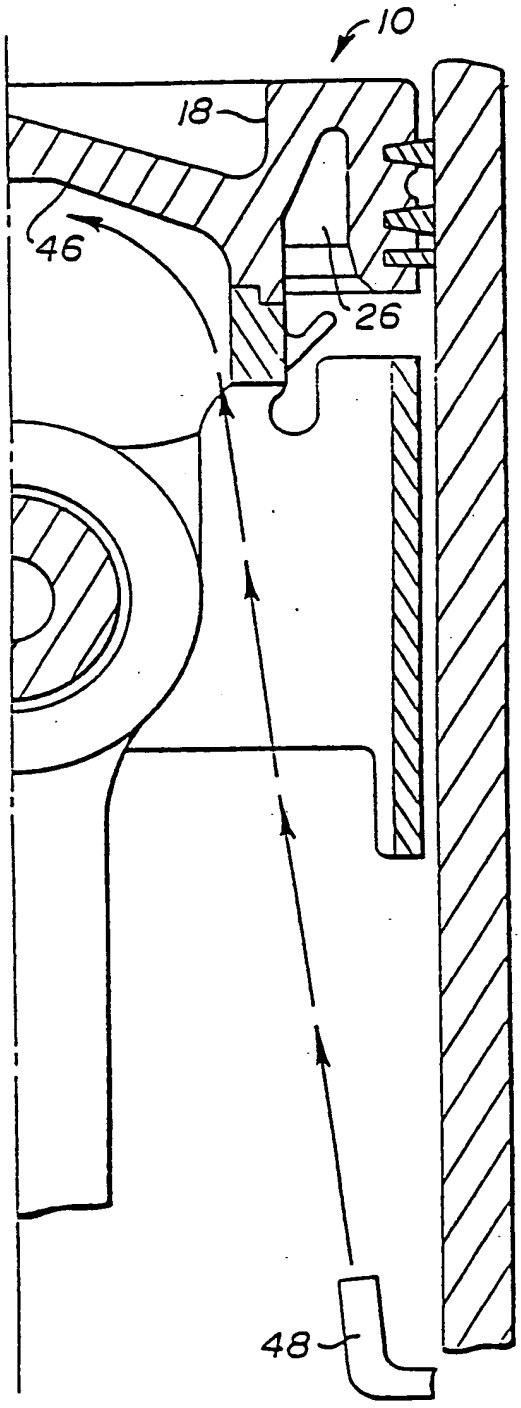


FIG. 10.